VALUATION OF QUESTIONS IN PRESENTATIONS OF GROUP PROJECTS

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ABSTRACT
This paper evaluates the effectiveness of using rounds of questions posed by work groups of an Engineering Project course after their project presentations. Before, students were offered the possibility of putting questions to speakers before the lecturer asked his/her own questions. Unfortunately, student participation was often very low and questions sometimes lacked depth, or were irrelevant or poorly stated. However, question time is a good moment to raise doubts, which can help presenters think about their project. That is, student and lecturer participation can open the minds of presenters to new ideas about their own work. Students' questions may even expand on the lecturer's questions and also create a spirit of positive criticism among students as part of student training. To enhance student participation, a controlled process is followed. Work groups think up and write questions which are later included in their project portfolio. Finally, student questionnaires are used to assess the process. Details of questionnaires and results, as well as an example of a project, are given elsewhere in the paper.

Keywords: Design improvement, round of questions, evaluation of questions

1 INTRODUCTION

This article describes an experience concerning the use of rounds of questions after oral presentations by student work teams of an Engineering Project course [1] taught during the final year (5th year) of a undergraduate degree in Chemical Engineering at the Technical University of Catalonia (UPC).
Work groups prepare a text and three related oral presentations to be delivered throughout the semester. The first delivery, i.e. the Bid of the Project, takes place approximately a month after the start of classes; the second, i.e. the Draft of the Project, is made at mid-course; and the final presentation, i.e. the Final Project, is given at the end of the course.

1.1 Oral presentations and rounds of questions

In the first semester of the 2012-13 academic year, Bids of Projects were orally presented by seven work groups (three to five students each), followed by a round of questions mostly posed by the lecturer, although students were encouraged to ask questions too.
The low level of student questioning is a problem because the round of questions is a useful way to practice constructive criticism of other works. Moreover, receiving questions helps to develop or improve aspects of own work and offers the opportunity of considering new ones. Reasons for student reluctance to ask questions to other groups include lack of habit in our educational culture, disinterest, convenience, fear of revenge by other groups when it is their turn to ask questions, etc. In order to tackle this problem, the following strategy was devised.

2 METHODOLOGY FOR IMPROVING THE ROUND OF QUESTIONS

This methodology pursues several objectives: Improvement of student attention during presentations; encouragement of in-group discussion to prepare questions for class peers; analysis of questions; and refinement of project development strategy.
In this first experience, the round of questions took place after the presentations of Drafts and Final versions.

2.1 Round of questions after presentations of Projects Drafts

Motivation and instructions about this practice were given to students before delivery of the presentations. After an oral presentation by one of the groups, the other six had approximately five minutes to discuss and write two questions down. Figure 1a and 1b shows group one questions to the other six groups and questions posed by these groups to group one, respectively.

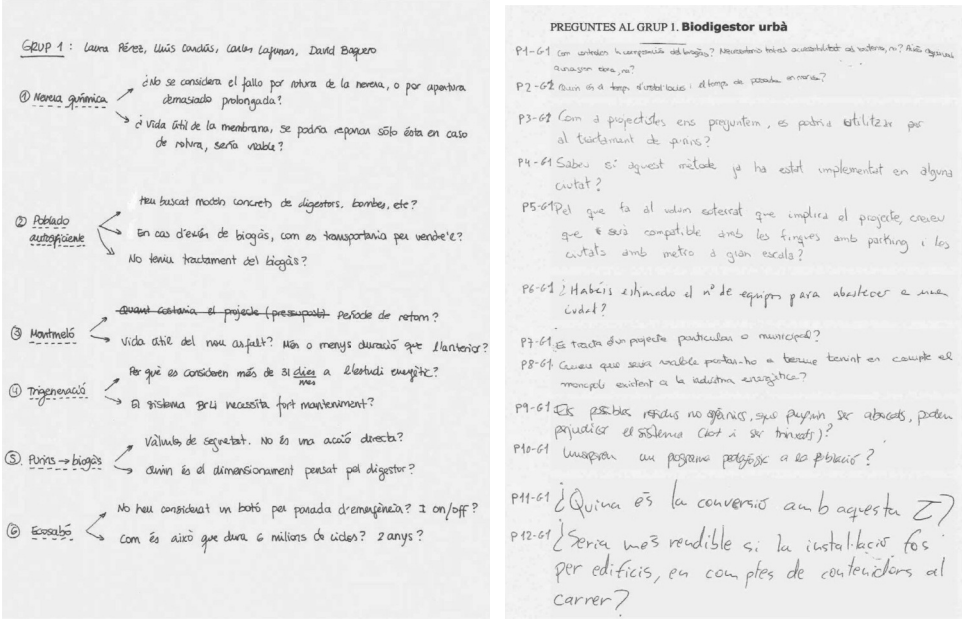

Figure 1. a) Group one (G1) questions to other groups (left); b) Questions posed by other six groups to group one (G1) (right), (most in Catalan)

The presenting groups had to answer approximately twelve questions each (some groups got 13 or 14 questions). At the end of the two presentation sessions, all groups handed their questions for the other groups to the lecturer.

In the next class, the lecturer gave each group the questions written by the other groups, together with two questionnaires, to evaluate the experience.

The first questionnaire required the identification of the group. The following question was asked: "... Go over the questions (Q) addressed to your group and classify them according to their significance, and then rank them from less (1) to more (12) important to improve your project". The results of this questionnaire are summarized in Table 1.

The second questionnaire, which was anonymous, included questions about their experience in formulating and receiving questions. Rated items included:

A) Preparation of questions to other groups (Table 2)
B) Answers given to your questions (Table 3)
C) Questions asked to your group (Table 4)
D) General (Table 5)

2.2 Round of questions after presentations of Final versions of Projects

After presenting all final versions, the groups prepared two questions for the other groups. However, only one was selected to increase the quality of questions, eliminate repetitions, and save time. The lecturer asked some final questions and performed a quality evaluation of all works.

At the end of the course students were given an anonymous questionnaire about the questions after all presentations (shown in Table 6).

3 RESULTS OF QUESTIONNAIRES

In the first questionnaire, every group categorized and ranked the questions put to them in order of importance (final results provided in Table 1).

Table 1. Results of first questionnaire by groups (G). Categorization of questions and %

	G1	G2	G3	G4	G5	G6	G7	Total	%
Only clarifies	5	7	4	1	6	7	5	35	40.2
Answers a curiosity	4	4	5	4	4	5	2	28	32.2
Is an aspect to work on	3	2	3	7	2	2	3	22	25.3
Helps to see alternatives	0	0	0	0	0	0	2	2	2.3
Promotes significant changes	0	0	0	0	0	0	0	0	0
Total	12	13	12	12	12	14	12	87	100

Most questions (72.4%) were rated as of low importance, i.e. "Only clarifies" (40.2%) and "Answers a curiosity" (32.2%), but "Is an aspect to work on" (25.3%) or "Helps to see alternatives" (2.3%), which represent 27.6% of questions, were interesting for the development of projects. No group chose "Promotes significant changes" for any question (0%).

The results of the second questionnaire are in Tables 2 to 5; The intermediate point between No and Yes is considered as indifferent (Indif).

Table 2. Results of 2nd questionnaire. Part A

A) About preparation of questions to other groups:	NO	Indif.	YES
Did it help you gain interest in your classmates' presentations?	0	0	7
Did it help you assess your classmates' work?	0	2	5
Did you eliminate any compromising questions because of your friendship with your classmates?	2	0	5
Would you increase the question preparation time?	4	1	2
Would you have asked more questions?	4	3	0

Question asking required students to listen more attentively during presentations, improving their evaluation skills. However, friendship between group members and fear of being asked compromising questions during their presentations led students to eliminate certain questions. To this regard, the lecturer pointed out that the scientific world must pose all kinds of questions to progress, and that companies also need challenging, compromising questions to prevent failure.

Finally, students found that the question preparation time (five minutes) was appropriate and that the number of questions (two) per group was sufficient.

Table 3. Results of 2nd questionnaire. Part B

B) About answers received to your questions:	NO	Indif.	YES
Were our questions answered satisfactorily?	1	2	4
Do you think your questions helped other groups reflect on aspects of their project?	0	2	4

In part B, the answers received from the other groups to the questions proposed were generally rated as satisfactory. Similarly, the questions proposed were considered interesting.

Table 4. Results of 2nd questionnaire. Part C

C) About questions asked to your group:	NO	Indif.	YES
Did you perceive any improvement in your presentation after the questions?	0	**3**	**4**
Did the questions help your group reflect on any new aspect of the project?	2	0	**5**
Is your group willing to modify any aspect of the project?	0	2	**5**
Is your group willing to find a new alternative of solution?	**6**	1	0
Is your group willing to change any aspect of the project radically?	**7**	0	0
Do you think questions were of a good overall standard?	**3**	**2**	2

Part C was devoted to questions by other groups. Answering them made students reflect on aspects of their project, but did not lead to any significant changes in the projects.

Table 5. Results of 2nd questionnaire. Part D

D) General:	NO	Indif.	YES
Do you consider this experience as globally positive?	0	1	**6**
Would you have rather the lecturer had been the only one to ask questions?	**5**	2	0

Six groups rated the experience as globally positive and one group was indifferent. Curiously, they did not want the lecturer to be the only one to ask questions; they wanted to ask questions, too. These results were encouraging enough to continue using this methodological process of student participation in the round of questions.

At the end of the course students were asked to answer another anonymous questionnaire about questions received and their impact on their final work (Table 6). The scale used ranges from 1 (strongly disagree) to 5 (strongly agree), [2].

Table 6. Final questionnaire and importance of questions for their project

Importance of questions for their projects after the preliminary Draft	**1**	**2**	**3**	**4**	**5**
Would it be interesting to ask questions after the Bid presentation?	2	1	1	2	1
Have you improved any aspects of your project or incorporated new ones?	0	1	2	2	2
If a new aspect was incorporated, how important was this incorporation?	0	2	**3**	2	0

The first question aimed to collect the students' views on using this question asking process after the first presentation (Bid), which is a less formal presentation. Opinions were varied on this one.

The second question was about the effect of questions on the improvement of already existing aspects or incorporation of new ones into the project. There was also a range of opinions, with a tendency to agreement.

Incorporation of new aspects into projects (question 3) was given an intermediate score between 1 (not important) and 5 (very important). Two groups rated it as of little importance, three as of medium importance, and two as of high importance. No 0 or 5 ratings were given.

4 AN EXAMPLE OF PROJECT

An example of a project developed by one of the work groups (G1) of the engineering project course of the Chemical Engineering degree, during the fall semester of the 2012-13 academic year, is presented. The title of the project is "Integrated design of a biodigester for a selective collection system to increase energy production from urban organic solid waste" [3].

The main objective -as stated by the students- was *to design a biodigester [5] for anaerobic digestion of urban organic solid waste to produce biogas and generate energy,* thus contributing to urban sustainability. The idea would be to place these biodigesters all over the city. Figure 2 shows the final poster of this work entitled 'In situ production of biogas. Clean energy for our city' ("Producció in situ de biogàs. Energia neta per a la nostra ciutat"). The system is composed of a top entry on the sidewalk and two main underground parts: a mechanical system with a storage tank to crush and store organic waste, and two digesters working in parallel.

The whole system can handle 1,100 kg of organic waste per day, which has five days of residence. At a temperature of 50°C the biodigester produces about 800 Nm^3 of gas, resulting in a 70% reduction of organic waste. This solid residue (Biol) is removed from the system and used as fertilizer. A control device automates the system. The following technical aspects were fully or partially resolved: a system to control the smell of gas, the lixiviate, removal of final waste and maintenance of the system. The project also includes a patent search, affecting rules, a cost study, investment return time, and a task schedule. As it is the first "Project" developed by the students, results are at a basic level.

With regard to the questions put by the other work groups, they were rated as a simple clarification (5), curiosity (4), and an aspect to work on (3). The questions rated as aspects to work on contributed positively to the final structure of this project.

Figure 2. Poster of main parts of Biogas production system (Catalan)

5 DISCUSSION AND CONCLUSIONS

The questions asking process had two main parts. The first consisted in the elaboration of questions by groups for their class peers. The second concerned the evaluation of questions put to groups using two questionnaires [6]. Additionally, students were given a third questionnaire [7] to assess the whole process.

Students were highly motivated by and participated in the experience actively, which was considered globally positive (Table 5), according to the questionnaires.

Regarding the importance of questions and their impact on the development of projects, students considered 25.3% (Table 1) of questions interesting enough to be developed in their project (after the preliminary Draft). Some questions can be highly interesting for their work.

The methodology was refined in the second semester by introducing the question asking part after the first presentation (Bid of the Project) because questions are more important in the early phases of the design process than in subsequent ones, when the design becomes increasingly fixed. Briefly, the process involves the following steps:

1. Groups have five minutes to prepare and write down two questions for the presenting group. All the questions are read out and the presenting group answers them.
2. At the end of the session the papers with the questions (Fig. 1a) are given to the lecturer, who groups all the questions by questions addressed to each group (Fig. 1b).

3. Groups receive all the questions numbered (Q1, ..., Qn) from the lecturer during the first class after the presentations, along with a questionnaire (Table 7) to classify questions qualitatively and in order of importance for their project (only the first five questions). This reflective analysis is an important part of this process.

Table 7. Example of questionnaire to qualify and rank questions

G_	Clarification/ Curiosity	Aspect to work on/ Alternatives	Change is needed		Order of importance
Q1	X				m
Q...					...
Qn		X			1

4. The generated documentation is included in the portfolio of project of each group, as part of their evaluation.

Optionally, students can be asked to answer three questions: Is it motivating for you to make clarifications and improvements in your following presentation? Have your peers' questions helped you discover any new aspects of your project? Do you think this system of question asking and its evaluation are positive?

The lecturer supervises every group throughout the classes. He/she can pose a few questions after the round of questions of each presentation, and evaluates the presentations and work done globally.

The use of ICTs in this process is planned for future course offerings.

Question asking engages students to participate actively during presentations, enhances their critical thinking skills and reinforces student confidence as they can see the impact of their questions on the development of other groups' projects, as well as of their own project. As a result, final designs are improved.

ACKNOWLEDGEMENTS

The author would like to thank all the students of the '*Projects'* course in the Chemical Engineering degree, taught in the fall semester 2012 for their participation, with a special mention to the group G1: who conducted the work [3] described in the paper.

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